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3 RODGERS, a citizen of the United States of America, a resident of Orange,
4 County of Orange, State of Texas; EUGENE D. MEDLOCK, a citizen of the
5 United States of America, a resident of Bridge City, County of Orange, State
6 of Texas; and ROGER KOLM, a citizen of the United States of America, a
7 resident of The Woodlands, County of Montgomery, State of Texas, have
8 invented new and useful improvements in a

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POLYMERIC BASED CARPET

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POLYMERIC BASED CARPET

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FIELD OF THE INVENTION

3 The present invention relates to a polymeric based carpet.

4

BACKGROUND OF THE INVENTION

5 It is desired in the textile industry to create products that are 100 percent
6 recyclable with minimum difficulty. Today's commercially provided carpet
7 products are predominantly manufactured using a latex based binder to
8 adhere the backing scrim to the carpet fibers. The purpose of the scrim and
9 latex are to bind the carpet fibers and prevent the fibers from becoming
10 unwoven or loose. The latex is undesirable from a recycling point of view. In
11 order to reclaim the carpet fibers and scrim, which are normally
12 polypropylene, polyester, or polyamide based, the latex has to be separated
13 from the total composite.

14 A method of making and recycling carpet of all recyclable material has been
15 disclosed. The disclosed carpet includes a primary backing having tufts of
16 synthetic carpet fibers protruding from a top surface and, optionally, a
17 secondary backing, with an extruded sheet of an isotactic polyolefin polymer
18 between and integrally fused to a bottom surface of the primary backing and
19 an upper surface of the secondary backing. The isotactic polyolefin polymers
20 shown to be effective to fuse the carpet fibers and the secondary backing in
21 the disclosure are isotactic polypropylene and extruded blends of
22 polypropylene with polyethylene, polybutylene and thermoplastic elastomers.
23 The previous disclosures teach that polyethylene copolymers alone are a
24 poor choice for such a fusion material. Furthermore, it has been disclosed
25 that if anything other than polypropylene is used for the face fiber, extruded

1 sheet and secondary back, that the bonding of the materials must be
2 physically separated before recycling can take place.

3 In contrast, in the present invention, the use of ethylene methyl acrylate
4 copolymers as such a fusion material replacement for latex conventionally
5 used to bind carpet fibers to backing material not only eliminates the need for
6 a separation recovery process but also enhances the total products'
7 performance when recycled. Furthermore, such a copolymer has advantages
8 over polypropylene and the various polypropylene blends previously
9 disclosed.

10 SUMMARY OF THE INVENTION

11 The present invention relates to a carpet composition, recyclable without a
12 separation step, having from 50 to 100 percent polymeric material comprising:

13 a) a tufted primary backing having a primary backing and tufts of
14 carpet fibers penetrating a bottom surface of the primary
15 backing and protruding from a top surface of the primary
16 backing;

17 b) a secondary backing material; and

18 c) an extruded adhesive material or a coextrusion of two or more
19 extruded adhesive materials binding an upper surface of the
20 secondary backing material to the bottom surface of the primary
21 backing;

22 in which the carpet fibers, primary backing material and secondary
23 backing material are selected from the group consisting of

1 polypropylene, polyester, acrylics, polyethylene, polyamide, nylon,
2 wool, cotton, rayon and combinations thereof;

3 and in which the adhesive material comprises an amorphous
4 polyethylene copolymer selected from the group consisting of ethylene
5 methyl acrylate, ethylene normal butyl acrylate, and blends of two or
6 more polyethylene copolymers.

7 In a preferred embodiment, the extruded adhesive material of the above
8 described carpet composition comprises a middle layer of polyethylene
9 sandwiched between two outer layers selected from the group consisting of
10 ethylene methyl acrylate and ethylene normal butyl acrylate.

11 In a more preferred embodiment, the middle polyethylene layer of the above
12 described extruded adhesive material is from 10 to 90 weight percent of the
13 extruded adhesive material and each of the two outer layers is from 5 to
14 45 weight percent of the extruded adhesive material.

15 In another preferred embodiment, the adhesive material of the above
16 described carpet composition further comprises maleic anhydride.

17 In yet another preferred embodiment, the adhesive material of the above
18 described carpet composition is a coextruded blend of ethylene methyl
19 acrylate copolymers and polymers selected from the group consisting of low
20 density polyethylenes, linear low density polyethylenes, high density
21 polyethylenes, ultra low density polyethylene having a density less than 0.915
22 density, ethylene-propylene copolymers, elastomers, rubber, EPDM (ethylene
23 propylene diene monomer) rubber, styrenic copolymers of butadiene, styrenic
24 copolymers of acrylonitrile, styrenic copolymers of ethylene, metallocene
25 based polyethylenes, polypropylene, polyester, ethylene acrylic acid
26 copolymers, ethylene methyl acrylic acid copolymers, butyl acrylate

1 copolymers, ethylene vinyl acetate copolymers, ionomers, polyamides, and
2 maleic anhydrides.

3 In still another preferred embodiment, the adhesive material of the above
4 described carpet composition has a thickness of from 0.001 inches to
5 0.050 inches.

6 In yet another preferred embodiment, the adhesive material of the above
7 described carpet composition further comprises additives selected from the
8 group consisting of flame retardants, odor reduction additives, scent
9 enhancing additives and ultra-violet light protection additives.

10 In still another preferred embodiment, the adhesive material of the above
11 described carpet composition further comprises fillers selected from the group
12 consisting of talc, calcium carbonate and other inorganic fillers.

13 The present invention also relates to a method of making a carpet, the carpet
14 comprising a tufted primary backing with a primary backing and tufts of carpet
15 fibers penetrating a bottom surface of the primary backing and protruding
16 from a top surface of the primary backing; a secondary backing material; and
17 an adhesive material binding an upper surface of the secondary backing
18 material to the bottom surface of the tufted primary backing; the carpet fibers,
19 primary backing material and secondary backing material being selected from
20 the group consisting of polypropylene, polyester, acrylics, polyethylene,
21 polyamide, nylon, wool, cotton, rayon and combinations thereof and the
22 adhesive material comprising an amorphous polyethylene copolymer selected
23 from the group consisting of ethylene methyl acrylate and ethylene normal
24 butyl acrylate; the method comprising the steps of:

25 a) extruding a heated sheet of the adhesive material; and

1 b) continuously fusing together in a two roll nip the upper surface of
2 the secondary backing and the bottom surface of the tufted primary
3 backing with the heated sheet.

4 In a preferred embodiment of the above described method, the two roll nip
5 comprises a hard roll and a soft roll.

6 In a more preferred embodiment of the above described method, the soft roll
7 has a diameter of from 4 to 20 inches and a hardness of from 5 to
8 100 shore D.

9 In another more preferred embodiment of the above described method, the
10 soft roll is comprised of rubber.

11 In still another more preferred method, the hard roll is a cooled metal chill roll
12 capable of maintaining a temperature below 120°F.

13 In yet another more preferred method, the two roll nip has pressure between
14 20 and 200 pounds per linear inch.

15 The present invention also relates to a method of using at least one of
16 ethylene methyl acrylate copolymer and ethylene normal butyl acrylate
17 copolymer to manufacture a carpet, the carpet comprising a tufted primary
18 backing with a primary backing and tufts of carpet fibers penetrating a bottom
19 surface of the primary backing and protruding from a top surface of the
20 primary backing; a secondary backing material; and an adhesive material
21 binding an upper surface of the secondary backing material to the bottom
22 surface of the tufted primary backing; the carpet fibers, primary backing
23 material and secondary backing material being selected from the group
24 consisting of polypropylene, polyester, acrylics, polyethylene, polyamide,
25 nylon, wool, cotton, rayon and combinations thereof and the adhesive

- 1 material comprising an amorphous polyethylene copolymer selected from the
- 2 group consisting of ethylene methyl acrylate and ethylene normal butyl
- 3 acrylate; the method comprising the steps of:
- 4 a) extruding a heated sheet of the adhesive material; and
- 5 b) continuously fusing together in a two roll nip the upper surface of
- 6 the secondary backing and the bottom surface of the tufted primary
- 7 backing with the heated sheet.
- 8 In a preferred embodiment of the above described method, the two roll nip
- 9 comprises a hard roll and a soft roll.
- 10 In a more preferred embodiment of the above described method, the soft roll
- 11 has a diameter of from 4 to 20 inches and a hardness of from 5 to
- 12 100 shore D.
- 13 In another more preferred embodiment of the above described method, the
- 14 soft roll is comprised of rubber.
- 15 In still another more preferred embodiment of the above described method,
- 16 the hard roll is a cooled metal chill roll capable of maintaining a temperature
- 17 below 120°F.
- 18 In yet another more preferred embodiment of the above described method,
- 19 the two roll nip has pressure between 20 and 200 pounds per linear inch.
- 20 The present invention also relates to a method of recycling a carpet, the
- 21 carpet comprising a tufted primary backing with a primary backing and tufts of
- 22 carpet fibers penetrating a bottom surface of the primary backing and
- 23 protruding from a top surface of the primary backing; a secondary backing

1 material; and an extruded adhesive material or a coextruded blend of two or
2 more extruded adhesive materials binding an upper surface of the secondary
3 backing material to the bottom surface of the primary backing; the carpet
4 fibers, primary backing material and secondary backing material being
5 selected from the group consisting of polypropylene, polyester, acrylics,
6 polyethylene, polyamide, nylon, wool, cotton, rayon and combinations thereof
7 and the adhesive material comprising an amorphous polyethylene copolymer
8 selected from the group consisting of ethylene methyl acrylate and ethylene
9 normal butyl acrylate; the method comprising the step of melting the carpet to
10 obtain an extrudate feedstock.

11 DETAILED DESCRIPTION OF THE INVENTION

12 A novel composite and process has been invented which creates a 50 to
13 100 percent polymeric product which allows it to be recycled. The composite
14 can provide water-resistant properties heretofore impossible with latex bound
15 carpet products. In addition, the new product can incorporate performance-
16 enhancing additives such as flame-retardants, odor reduction additives,
17 scent-enhancing additives, ultra-violet light protection additives and inorganic
18 materials, such as talc and calcium carbonate, for cost reduction and strength
19 properties. It has also been found that when calcium carbonate is added as a
20 filler, it functions as a "heat sink", i.e., it lets the polymer blend stay hot longer
21 during the manufacturing process. This has the effect of improving the
22 penetration of the polymer into the carpet fibers.

23 With the use of ethylene methyl acrylate based copolymers, the carpet can
24 now be ground and reprocessed with no interim step to remove incompatible
25 materials. When incorporated with polypropylene, polyester and polyamide
26 polymers, methyl acrylate copolymers act as a compatibilizer to cause the
27 new blend to adhere to itself in any subsequent fabrication process.

1 The use of ethylene methyl acrylate copolymers as a replacement for latex
2 conventionally used to bind carpet fibers to backing material not only
3 eliminates the need for a separation recovery process but also enhances the
4 total products' performance when recycled. The ethylene methyl acrylate
5 material serves as a binder for the reclaimed product as well as improving the
6 impact resistance and pliability of the secondary produced product.

7 In addition to the novel materials used in the new composite, certain
8 processing techniques are employed that guarantee the proper level of
9 adhesion is obtained in the laminate. These techniques a rubber nip roll with
10 a diameter of 4 to 20 inches, and a hardness of 50 to 100 shore D. A
11 water-cooled metal chill roll capable of maintaining a temperature below
12 120°F. The pressure of the rubber to steel nip is between 40 and 200 pounds
13 per linear inch. Extrudate temperatures greater than 550°F is preferred.

14 EXAMPLES

15 The invention will be further illustrated by the following examples, which set
16 forth particularly advantageous method embodiments. While the Examples
17 are provided to illustrate the present invention, they are not intended to limit it.

18 Example 1

19 Various samples of carpet were manufactured having tufts of polypropylene
20 interwoven in a primary backing of polypropylene with an extruded sheet of
21 ethylene methyl acrylate copolymer sandwiched to the bottom of the primary
22 backing and the top of a secondary backing of polypropylene. The carpets
23 were made in two different weave styles and at various extrudate speeds and
24 temperatures. The Fiber Lock and Tuft Bind tests were applied to the
25 samples and were scored with Pass (P), Marginal (M) or Fail (F) scores. The
26 results are shown in Table 1.

1

Table 1

Style	Temperature	Speed	Fiber Lock Score
Seacroft	575	100	Marginal
Seacroft	575	75	Pass
Seacroft	575	50	Pass
Seacroft	600	75	Pass
Glasgow	575	100	Pass
Glasgow	575	75	Pass
Glasgow	575	50	Pass
Glasgow	600	75	Pass

2

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Example 2

4 Various samples of carpet were manufactured having tufts of polypropylene
5 interwoven in a primary backing of polyamide with an extruded sheet of
6 ethylene methyl acrylate copolymer sandwiched to the bottom of the primary
7 backing and the top of a secondary backing of polyamide. The carpets were
8 made in different weave styles and at various extrudate thicknesses and
9 temperatures. The Fiber Lock and Tuft Bind tests were applied to the
10 samples and were scored with Pass (P), Marginal (M), or Fail (F) scores. The
11 results are shown in Table 2.

Table 2

Style	Extrudate Temp.	Extrudate Thickness	Fiber Lock Score	Tuft Bind Score (lb.)
Sample 1	575	5.0 mils	Fail	6.0
Sample 1	575	7.5 mils	Fail	8.0
Sample 1	575	10 mils	Pass	8.5
Sample 1	600	7.5 mils	Marginal	8.0
Heavier wt. Level loop – Polyamide				
Sample 2	575	5.0 mils	Marginal	9.0
Sample 2	575	7.5 mils	Pass	8.5
Sample 2	575	10 mils	Pass	8.0
Sample 2	600	7.5 mils	Marginal	10.5
Sample 3	575	5.0 mils	Pass	8.0
Sample 3	575	7.5 mils	Pass	12.0
Sample 3	575	10 mils	Pass (much better)	10.0
Sample 3	600	7.5 mils	Pass	N/A
Textured Level loop – Polyamide				
Sample 4	575	5.0 mils	Marginal	10.0
Sample 4	575	7.5 mils	Pass	12.0
Sample 4	575	10 mils	Pass	10.0
Sample 4	600	7.5 mils	Pass	10.0
Polyamide				
Sample 5	575	5.0 mils	Fail	10.0
Sample 5	575	7.5 mils	Fail	10.0
Sample 5	575	10 mils	Marginal	8.0
Sample 5	600	7.5 mils	Marginal	8.0
26 oz. P.A. Level loop – Polyamide				
Sample 6	575	5.0 mils	Fail	9.5
Sample 6	575	7.5 mils	Marginal	10.0
Sample 6	575	10 mils	Pass	6.0
Sample 6	600	7.5 mils	Marginal	8.0
Polyamide				
Sample 7	575	5.0 mils	Marginal	8.5
Sample 7	575	7.5 mils	Pass	10.5
Sample 7	575	10 mils	Pass	12.0
Sample 7	600	7.5 mils	Pass	12.0
Level loop – Polyamide				
Sample 8	575	5.0 mils	Pass	N/A
Sample 8	575	7.5 mils	Pass	N/A
Sample 8	575	10 mils	Pass	N/A
Sample 8	600	7.5 mils	Pass	N/A
Cut pile – Polyamide				

- 1 While the present invention has been described with reference to specific
- 2 embodiments, this application is intended to cover those various changes and
- 3 those skilled in the art may make those substitutions without departing from
- 4 the spirit and scope of the appended claims.